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ABSTRACT

Flowcharting, a skill used to program computers, can be used to teach reading skills. Like programing, flowcharting requires knowledge of a particular content area and an understanding of how to process the information. Skills such as identifying the main idea and supporting details, sequencing ideas or statements, and distinguishing relevant from irrelevant facts reflect some of what is needed to flowchart any idea. A six-step system for teaching skills in both flowcharting and reading begins with the teaching of flowcharting symbols. The second step introduces the sequencing of ideas and events. Next, students are asked to organize ideas on a flowchart, which helps ease them into using flowcharts to organize ideas into sequential order. As a reading skill, it can be used for recognizing the main idea; identifying supporting details; identifying and using symbols, diagrams, and typographical aids; and identifying key or direction words. The fourth step requires students to write down steps for an activity in flowchart form. Particular emphasis is given to using symbols and typographical aids since the students are responsible for framing each statement. In the fifth step, questions are formulated for students to answer about the flowchart, thus indicating their ability to read and understand flowcharts. During the final step, students put a paragraph's ideas in flowchart form, using flowchart principles to reflect their comprehension. (HOD)

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"Reading and Flowcharting: Interfacing Functions of Computer Literacy"

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Computers have brought on a nearly perfect revolution. They have caused radical and pervasive changes in our society without physical violence. They also have elevated the level of productivity by automating the thinking function. The only thing that they have not done is prepare educators for the teaching aberrations caused by such explosive changes.

This article seeks to alert reading educators, in particular, to ways in which flowcharting, a skill used to program computers, can be used to teach reading skills.

Flowcharts are the pictorial representations of computer programs. They use special symbols and arrows to create a "map" of what the computer will do (Dwyer and Kaufman, 1973). Flowcharting, like programming, requires knowledge of a particular content area and an understanding of how to process the information.

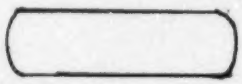
The content may involve gradations of any selected area (for instance, in math, a flowchart or program can include basic addition or, on a higher level, integral calculus). Processing the content requires the same kinds of reading/study skill strategies used to understand literature, science, math, etc. Such skills as identifying the main idea, identifying supporting details, sequencing ideas or statements, and distinguishing relevant from irrelevant facts reflect some of what is needed to flowchart or program any idea.

Flowcharting, unlike programming, does not require mastery of a computer language (e.g., BASIC - Beginner's All-purpose Symbolic Instruction Code). Therefore, as reading educators, we have the expertise to help our students develop strategies for competent flowcharting.

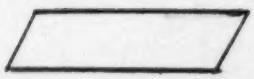
What follows is a series of steps for developing skills in both flowcharting and reading. These steps can be adjusted to meet the needs of students at any grade level.

Step 1 - Flowchart Symbols

Teach and reinforce flowcharting symbols. Just as you cannot read without knowledge of the alphabet letters, you cannot flowchart without knowledge of the appropriate signs and symbols. If students know when and how to connect four basic shapes with arrows, they can design any respectable flowchart.

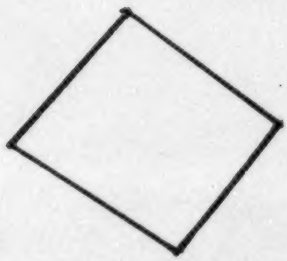


OVAL signifies START or END of program.

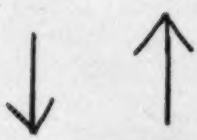


PARALLELOGRAM signifies INPUT or OUTPUT box.

RECTANGLE signifies any PROCESSING operation except a decision.



DIAMOND signifies DECISION box. The lines leaving the decision box are labeled with the decision result (yes or no) which causes each path to be followed.



ARROWS signify the direction of flow through the flowchart.

Step 2 - Sequencing

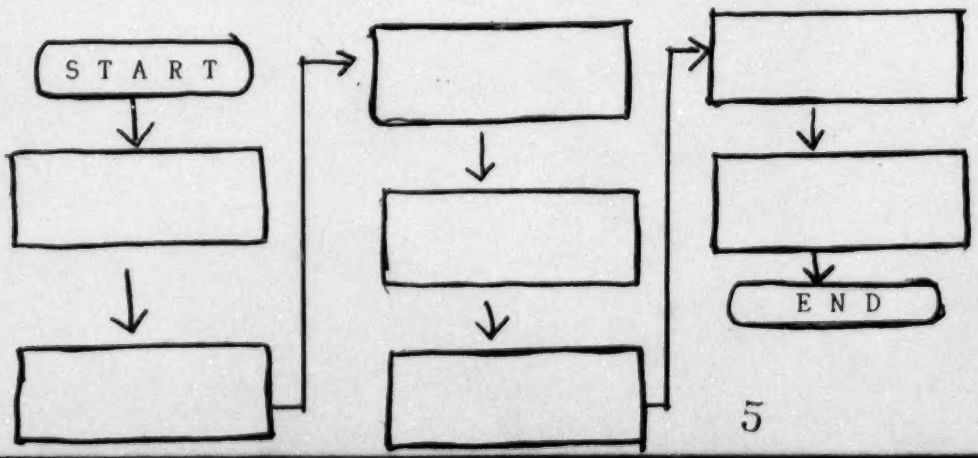
Begin by having students recognize the sequence of events, be it an array of pictures or words in jumbled order, a story told orally or silently or a jumbled cartoon script. Have students tell the order of events and their rationale for such an order. Provide opportunities for students to devise and sequence their own ideas (e.g., brushing teeth, opening gifts, starting the car).

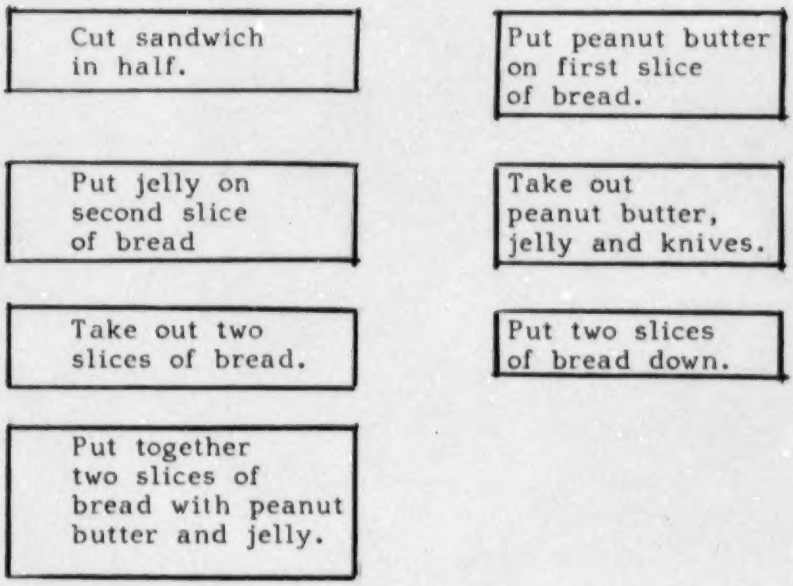
Sequencing ideas and events, at any level, is a critical first step in learning to flowchart. It also is a necessary literal comprehension skill for developing reading competence. Helping students to understand the importance of putting programmed ideas into the proper sequence is easy if you relate it to everyday events; for instance, the absurdity of going to school before getting dressed or taking a test before studying for it.

Step 3 - Organizing Ideas on a Flowchart

Make a flowchart with empty rectangular boxes. Beneath the flowchart, write down six to nine steps, in jumbled order, for any activity. Have students cut them out and paste them in correct order on the rectangles in the flowchart.

A flowchart for making a peanut butter and jelly sandwich might look like the following:

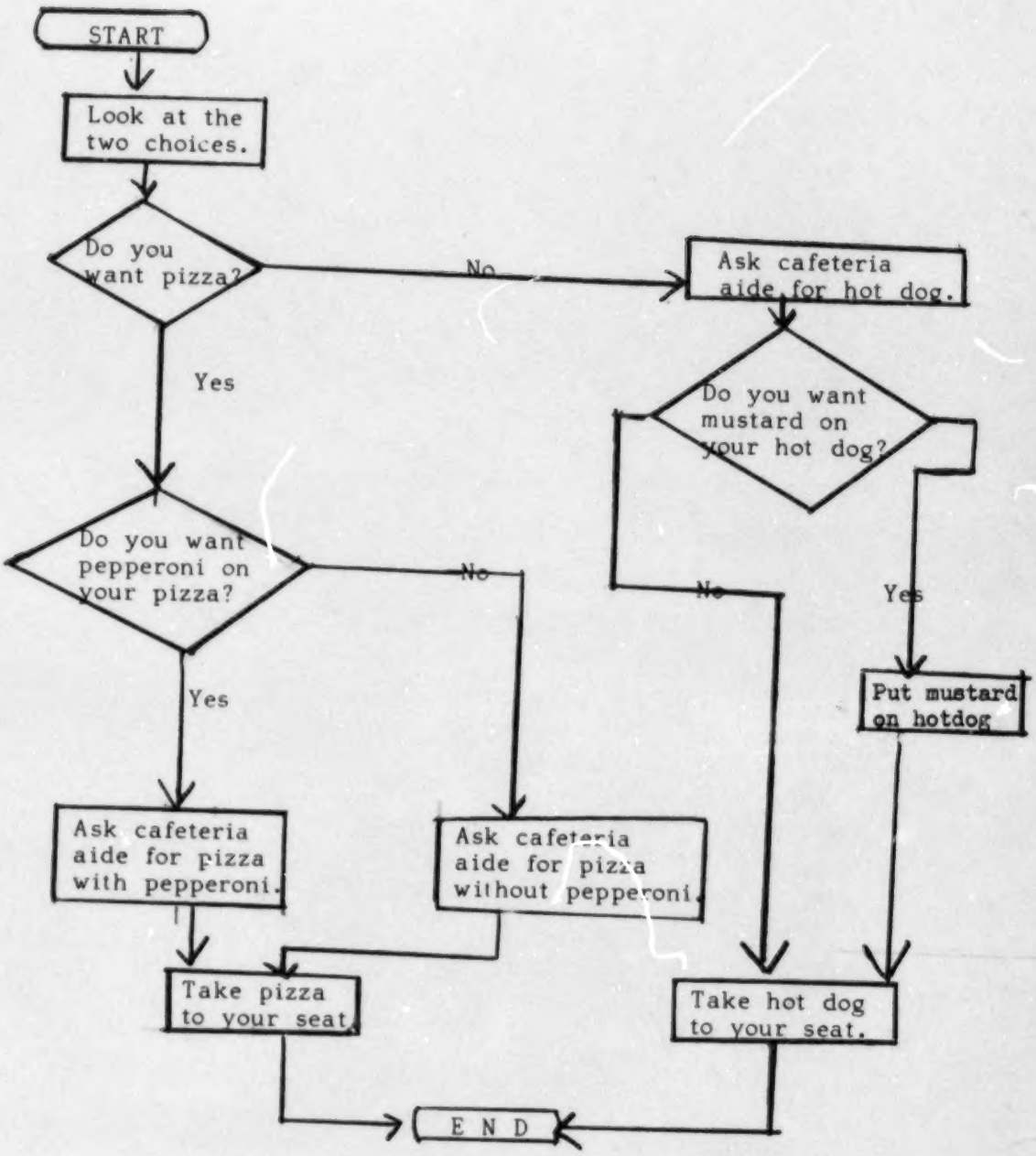



Cut sandwich in half.
Put peanut butter on first slice of bread.
Put jelly on second slice of bread
Take out peanut butter, jelly and knives.
Take out two slices of bread.
Put two slices of bread down.
Put together two slices of bread with peanut butter and jelly.

This study eases students into using flowcharts to organize ideas into sequential order. As a reading skill, aside from sequencing ideas, it can be used for recognizing the main idea (making a peanut butter and jelly sandwich), identifying supporting details (need peanut butter, jelly, two slices of bread, knife, etc.), identifying and using symbols, diagrams and typographical aids (flowchart format), and identifying key or direction words (put, cut, take out).

Step 4 - Framing Flowchart Symbols

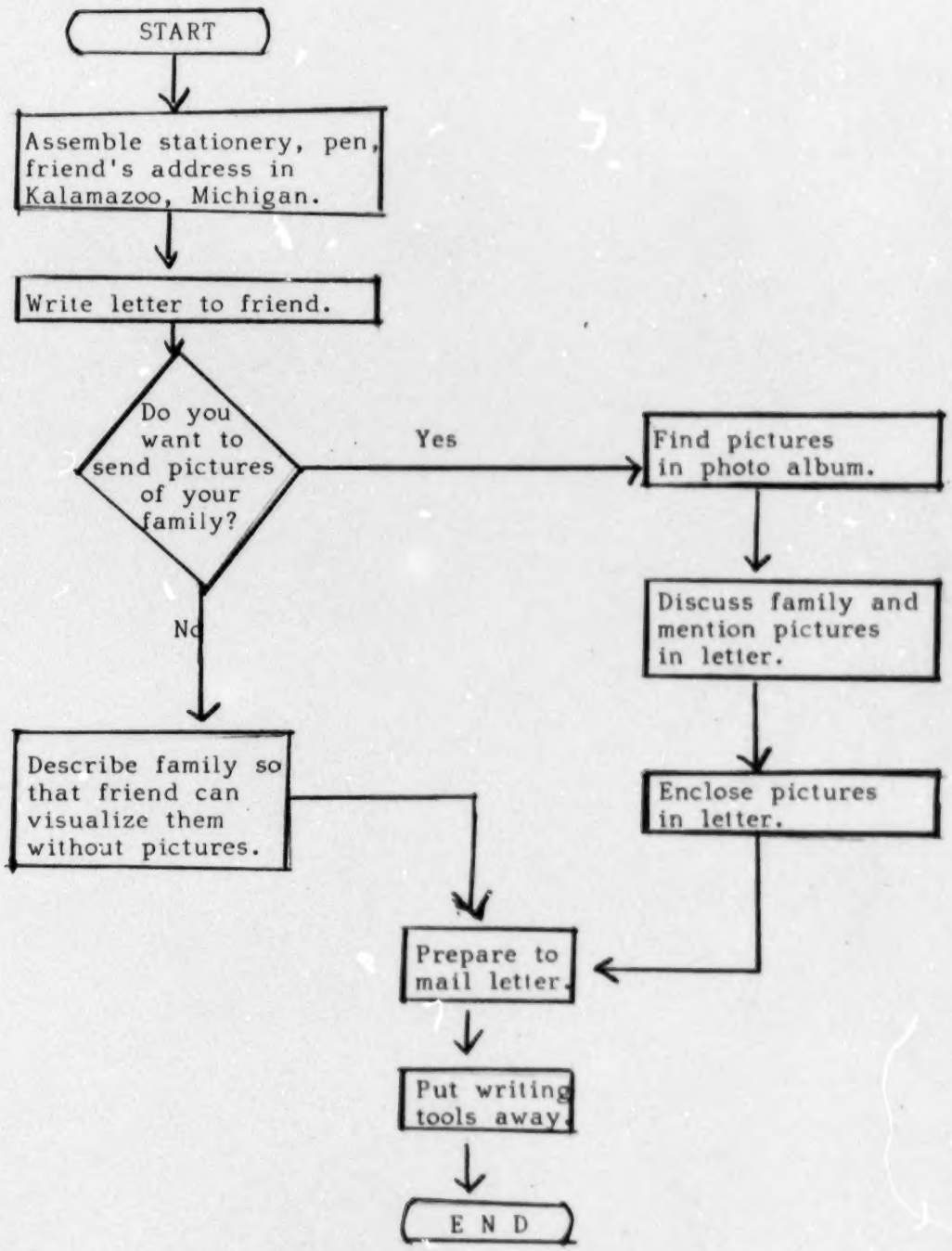
Write down steps for doing an activity in flowchart form. Select an activity where choices are involved. Frame the steps with the correct flowcharting symbols. An example is selecting one lunch in the cafeteria when your two favorite foods are being offered; pizza or hot dogs.


START
Look at the two choices.
Do you want pizza?
No
Ask cafeteria aide for hot dog.
Yes
Do you want mustard on your hot dog?
Do you want pepperoni on your pizza?
No
No
Yes
Yes
Put mustard on hotdog
Ask cafeteria aide for pizza with pepperoni.
Ask cafeteria aide for pizza without pepperoni.
Take pizza to your seat.
Take hot dog to your seat.
E N D

This activity allows students to focus on using flowcharting symbols correctly. It also helps students to follow the flowchart flow when decisions are included. Those reading/study skills addressed include those from the previous steps plus the following: using punctuation to obtain meaning (knowing when to make or fllow a decision); identifying cause and effect relationships (knowing what happens if you do not want pizza); evaluating logic and consistency (using decision-making process of getting from two choices to one selection); relating supporting details to main ideas (remembering reason for selecting only one food) and following main point of directions sequentially (follow food selection process). Particular emphasis is given to using symbols and typographical aids since the student is responsible for framing each statement.

Step 5 - Questioning About A Flowchart

Create a flowchart for any activity or area of interest. Formulate questions for students to answer about the flowchart. The following example incorporates the decision box:


START
Assemble stationery, pen, friend's address in Kalamazoo, Michigan.
Write letter to friend.
Do you want to send pictures of your family?
Yes
No
Find pictures in photo album.
Discuss family and mention pictures in letter.
Enclose pictures in letter.
Describe family so that friend can visualize them without pictures.
Prepare to mail letter.
Put writing tools away.
E N D

Questions

Suppose you wanted to send your friend pictures of your family? What are your next two steps?

Suppose you did not want to send your friend pictures of your family? What are your next two steps?

How many total steps do you have to take if your major decision is yes? No?

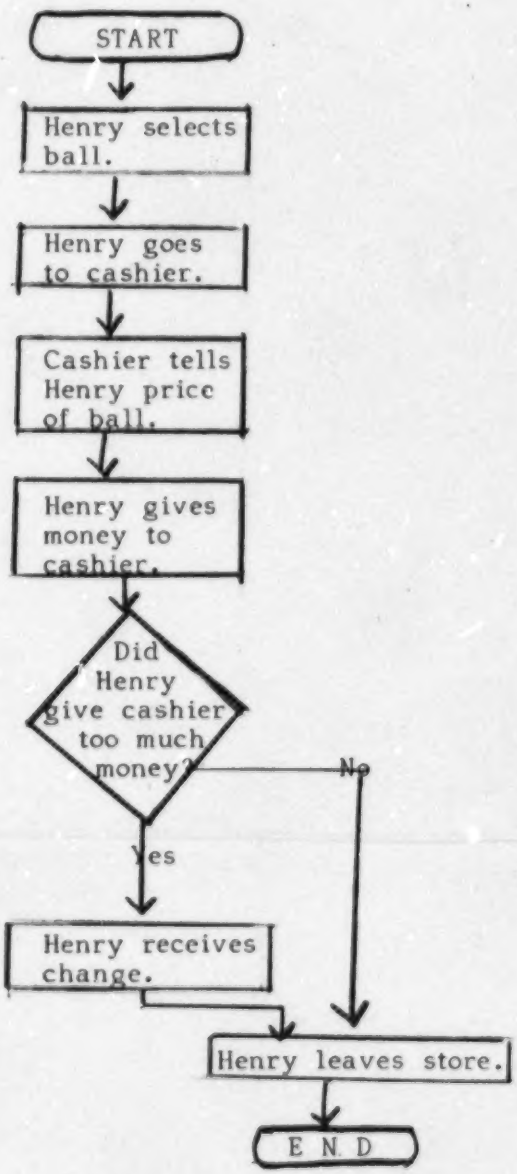
Which decision takes longer to do?

Answering questions about the flow of events in a flowchart indicates student's ability to read and understand flowcharts. It gives students opportunities to think about the order of events. Once competence is achieved for preceding questions, others may be designed which tap critical and creative levels of thinking (e.g., what other decisions could the writer make? Write them in flowchart form. Why do you think the writer would decide not to send pictures?) Additional reading/study skills tapped are distinguishing relevant from irrelevant facts (don't enclose pictures if not sending them), remembering details in directions (recalling steps in program) and synthesizing directions (answering questions about total flow of events).

Step 6 - Flowcharting From Paragraphs

Take or write any simple paragraph. Have students put the paragraph's ideas in flowchart form. Once proficiency is acquired, have students write their own paragraphs to flowchart. For example:

"Henry selects a ball to buy in the toy store. He approaches the cashier. The cashier tells him how much money he needs. He gives her money to pay for the ball. He receives his change. He leaves the store."



Once transformed into flowcharts, these same paragraphs can be written as simple programs to familiarize them with the programming format.

```
10 Print "Henry selects ball"
20 Print "Henry gives ball to cashier"
30 Input A (Price of ball)
40 Print "Henry gives money to cashier"
50 Input B (Amount of money Henry gives cashier)
60 C = B - A
70 Print "Henry receives change"
80 Print "Henry leaves store"
90 END
RUN
```

Designing flowcharts and programs from ideas in sentence or paragraph form indicates the student's ability to apply the reading/study skills addressed in preceding activities. In sequencing and outlining the ideas presented, students definitely need to comprehend what they are reading and use flowchart principles to reflect their understanding. Flowcharts can be created for any area -- from household chores (fixing leaky faucet) to daily routines (getting dressed, preparing meals) to good and bad habits (lighting a pipe, doing exercise) to scientific experiments (studying effects of sorbitol on mice) to historical events (documentation of Watergate chronology).

In working with flowcharts, students strengthen many reading skills which would otherwise go unnoticed; in using reading/study skills, students design less flawed and more appropriate flowcharts.

Ultimately, what should happen is that our students will become literate with both the printed page and the computer. Therefore, it behooves us to work expeditiously and collectively in developing our students' multifaceted literacy skills.

PLEASE NOTE: Reading skills taken from Computer Reading Skills Array compiled by author from various content area skills arrays.

Reference

Dwyer, Thomas A., and Michael S. Kaufman
A Guided Tour of Computer Programming in BASIC.
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